



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

IMPROVING THE NAVY'S OFFICER BONUS PROGRAM EFFECTIVENESS

by

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June 2006

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IMPROVING THE NAVY'S OFFICER BONUS PROGRAM EFFECTIVENESS

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ABSTRACT

Bonuses serve as a valuable tool in attracting and retaining Naval officers. This thesis analyzes the way officer bonuses are currently distributed in the Navy and provides recommended changes based on analysis of scholarly publications. Combining the information gained from current policies and research already conducted in the academic arena, the author proposes a workable bonus structure to meet recruitment and retention goals while providing the Navy flexibility, quality personnel, and cost effectiveness. Combining auction theory and signaling theory into a new program has great potential to provide flexibility to the Navy, maintain the appropriate quantity and quality of officers, and provide cost savings to the Navy, while providing continued servicemember satisfaction. By offering bonus programs of different rates and time commitments, effectiveness and personnel quality can be increased by allowing officers to signal their intentions to the Navy. Auctions can be used to determine the appropriate monetary values to offer under each contract. By implementing an auction for bonus amounts, the Navy helps to ensure that bonuses will be competitive with the overall job market. This approach provides the Navy with a flexible, effective officer bonus program that is responsive to existing job market conditions.

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I. INTRODUCTION

A. PURPOSE AND OBJECTIVES

While the actions of the United States military depend heavily on technology, weaponry, and infrastructure, the fundamental element of a successful military is a complete and competent array of personnel. Though the required number of personnel and their required skills change over time, the necessity of the military to attract and retain servicemembers is unchanging. As a result, attention must be paid to personnel policies in an attempt to maximize program effectiveness.

Continual spending increases by the Department of Defense on costs associated with personnel provide another impetus to review the personnel pay structure. While bonuses account for a small fraction of Military Personnel Navy (MPN) spending, it is an area worthy of being addressed because of the large impact it can have on military members' individual choices. As a result, it can lead to changes in behavior that impact other costs, such as training, education, or recruitment, when valuable servicemembers opt not to continue their military careers.

Bonuses serve as valuable tools in attracting and retaining Naval officers. However, they are not always cost effective. Naval aviators can be used as an example. Naval aviators receive bonuses and special pays that are described in detail in Chapter III. During times when commercial pilots are in high demand, increasing competition in the job market for existing pilots, the Navy's aviation bonus and special pays can be seen as effective because of the significant costs required for the Navy to recruit and train new pilots to replace those who leave for the private sector. On the other hand, when commercial pilots are not in high demand due to other market forces, the bonuses and special pays that aviators receive can be seen as ineffective since the Navy could have likely retained the pilots with a smaller bonus.

The purpose of this thesis is to analyze the way officer bonuses are currently distributed in the Navy and provide recommended changes based on analysis of scholarly publications. The Navy's approach will be contrasted with other compensation schemes and theoretical applications. Applying these principles will result in a new bonus structure allowing the Navy to realize cost savings while attracting and retaining the proper number of qualified officers.

B. RESEARCH QUESTIONS

The question of how to structure Naval Officer bonus programs, and compensation as a whole, is one that has been continually revisited since the All Volunteer Force (AVF) began in 1973. Deservedly so, because effective employers must constantly review and assess their incentive structure to ensure that it remains relevant and efficient as labor market forces change. This research aims to address both structural and effectiveness issues.

1. Primary Question

How might the bonus structure for Naval Officers be changed to meet recruitment and retention goals, with qualified personnel, while providing the Department of the Navy with flexibility and cost effectiveness as the military and civilian labor markets change?

2. Secondary Questions

In order to fully address the primary questions, several secondary questions will have to be answered in the development of this thesis. These questions include the benefits and weaknesses of the current system; potential improvements through the use of existing auction and job market signaling analysis; the feasibility of incorporating these concepts into a workable Naval Officer bonus program; and the potential long-term impact of such a program.

C. THESIS SCOPE

This thesis focuses on the Unrestricted Line (URL) Officer population of the United States Navy. United States Marine Corps policies are not addressed, as USMC policies have been largely successful and do not necessarily compare with those of the Navy. Historically, Marines have enacted their own policies for recruitment and retention and will continue to do so in the future based on their own unique situation. To understand the background of Navy bonuses, research was conducted into the various bonus programs employed by the Navy today. To gain insight into other means of attracting and retaining employees, various academic sources were consulted and are incorporated into the thesis. While the analysis will specifically address the Navy's URL Officer population, aspects of the recommendations can be incorporated into the various other services as appropriate.

D. METHODOLOGY

The methodology used in this thesis consisted of a literature review and combining appropriate elements of the literature into a cohesive bonus structure that might provide the Navy with improved cost effectiveness. Military compensation policies were reviewed to provide clarity as to where the Navy is today. Academic literature was then reviewed to address the application of auction theory and signaling theory to the job market in which the Navy directly competes.

Combining the information gained from the goal of current policy and the research already conducted in the academic arena, the author proposes a workable bonus structure to meet the recruitment and retention goals while providing the Navy flexibility, quality personnel, and cost effectiveness.

E. CHAPTER OVERVIEW

This document is arranged in six chapters to provide a logical and descriptive approach to the recommendations regarding the Navy Officer Bonus program.

Chapter I provides a general overview of the paper, including the objectives of the thesis, and addresses the questions to be answered. Next the scope of the topic is discussed along with the methodology used in reaching the conclusions contained in the text.

Chapter II outlines the current compensation structure in today's military. The various monetary and non-monetary forms of compensation are briefly discussed, along with an analysis of some issues that arise from the continued use of the military compensation system.

Chapter III gives a detailed account of current bonus programs in use by the United States Navy for Unrestricted Line Officers. The chapter is broken down into communities: Aviation Warfare, Submarine Warfare, and Surface Warfare.

Chapter IV provides the reader with an overview of Auctions and illustrates the various terms used in the discussion of auction theory. Furthermore, the different types of auctions are described. The chapter concludes with a summary of where auctions are used in practice and their applicability and appropriateness to the Navy Officer Bonus program.

Chapter V covers Signaling Theory, providing the reader with a background on how Signaling theory is used in the market today along with ideas about its applicability to the Navy.

Chapter VI is the final chapter, outlining how Auction Theory and Signaling Theory can be combined to provide the Navy cost effectiveness in the area of Officer Bonus Programs. Recommendations are provided along with the expected results of implementing such a program, both in the near and long

term. Areas of further research are also discussed, where additional study could yield increased savings and efficiency with proper application to the Navy Officer Bonus Program.

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II. MILITARY COMPENSATION OVERVIEW

Before addressing the specifics of the Navy's officer bonus programs, it is necessary to briefly outline the current Navy pay structure, which is the same in many respects, to the overall military pay structure. The current officer pay system compensates military members via monetary payments and via non-cash services and benefits.

A. MONETARY COMPENSATION

1. Base Pay

Base pay is the largest component of military compensation, comprising about 50 percent of all monetary compensation.¹ Base pay is determined based on a servicemember's rank and years of service. Different Base Pay tables are used for Officers and Enlisted personnel, but base pay is not based on one's specific job within a given category.

2. Housing Allowances

For those military members who do not live in Navy-provided quarters, a Basic Allowance for Housing (BAH) is provided to offset local rent or mortgage payments. This pay varies by location commensurate with the relative prices of area housing, but also varies based on one's rank and number of military dependants. Officers stationed overseas receive a housing allowance called Overseas Housing Allowance in lieu of BAH. Additionally, in locations with an especially high cost of living, such as Hawaii or San Diego, CA, military members are eligible to receive a Cost of Living Allowance (COLA).

1. Paul F. Hogan. "Overview of the Current Personnel and Compensation System." In Cindy Williams (ed.), *Filling the Ranks: Transforming the U.S. Military Personnel System*. Cambridge, MA: MIT Press, 2004

3. Sustenance Allowances

Navy Officers receive a monthly payment for the purpose of offsetting food expenses. This Basic Allowance for Sustenance (BAS) is common across all pay grades and does not vary with location or family composition.

4. Special Pays and Bonuses

There also exist various other special pay programs that are either occupation-specific or location specific. Examples of these include Submarine Pay, Aviation Pay, Sea Pay, Family Separation Pay, and Combat Pay. These payments compensate for members being away from home or directly in harms way. Additionally, the bonuses for Aviators, Submarine Officers, and Surface Warfare Officers are a means of attracting new entrants into a given community and retaining existing members that have already been trained. Bonuses are described more thoroughly in CHAPTER III. It is in this area of compensation where payment variations occur irrespective of age, tenure, or an individual's number of dependents. As a result, these payments are used "to respond to retention or recruitment problems that vary by military occupation, by location or assignment or other circumstances."² Nevertheless, special pays, allowances and bonuses make up only about four percent of cash pay and three percent of total military compensation, according to the 2002 Report of the Ninth Quadrennial Defense Review of Military Compensation.

5. Retirement Pay

The military retirement system is quickly becoming one of the last defined-benefit plans offered to new employees. After completing 20 years of active service, military members are fully vested in the military pension plan, with no vesting prior to the 20-year point. Nevertheless, the present value of such a guaranteed stream of payments is very large. However, many new entrants to

2. Paul F. Hogan. "Overview of the Current Personnel and Compensation System." In Cindy Williams (ed.), *Filling the Ranks: Transforming the U.S. Military Personnel System*. Cambridge, MA: MIT Press, 2004

military service undervalue the potential pension for which they may become eligible, putting more focus on yearly pay and compensation. This could be, in part, a result of the large discount rate often used by younger workers and the perceived-distant time horizon until retirement is an option. On the other hand, some servicemembers may very well have no intention to serve 20 years, and as a result place no value on the potential retirement pay.

B. NON-MONETARY COMPENSATION

1. Healthcare

Military members and their families receive medical and dental coverage through the TRICARE system. As healthcare costs rise in the U.S. market, so too do the Navy's expenditures on healthcare for its employees. While this is a non-monetary benefit to members, it is a real expense for the Navy and the Department of Defense as a whole.

2. Services

Military members also enjoy the use of various services from which non-military members are restricted. Namely, Defense Commissaries, Navy Exchanges, and various Morale, Welfare, and Recreation (MWR) services available only to uniformed personnel. These institutions generally offer goods and services at prices that are well below the civilian equivalent. Similarly, services are available to members and their families, such as spousal employment assistance, financial consulting and services, legal services, and low-cost child care centers.

3. Tax Exemptions

While the "pays" described above are taxed as ordinary income under the federal tax code, those designated as "allowances" are not. Yet another benefit

that military members receive is the tax exemption of a significant portion of their pay. For instance, BAH, BAS, and COLA are some of the benefits that are not taxed at all. Even the military members who live in military quarters, who therefore do not receive BAH, are still receiving an equivalent amount of housing which is effectively tax-free. Those members who buy their own home not only receive the federal mortgage interest deduction, but they are able to pay at least part of their mortgage with what amounts to pre-tax dollars. Pay earned while serving in combat zones is very often tax-free as well.

4. Personal Satisfaction

Though not quantifiable, it cannot be ignored that members of the Armed Forces receive some sense of accomplishment as a result of their service. These benefits might come in the form of self-confidence, sense of duty, personal pride, and various other intrinsic motivators and hygiene factors. Military pay policy and cost analysis cannot address this form of compensation to the servicemembers, but military regulations and personnel treatment can be crafted under the recognition that members of the uniformed services perform their jobs not only for pay and services. In addition, the training received by servicemembers can be considered a form of compensation. Many skills learned while performing military service are transferable to the private sector.

C. NAVY COMPENSATION ANALYSIS

1. Total Compensation

As seen above, the Navy, and military as a whole, is wrought with various sources of compensation, which come in both monetary and non-monetary forms. This general structure has been in place in excess of a half century. Though the pay, benefits, and services available to members is significant, they are not valued by all servicemembers equally. For instance, single personnel

receive no benefit from the multitude of family services that are available. Nevertheless, there is no equal service available in its place. Similarly, those choosing to live further away from their duty station do not enjoy the benefits of childcare services available near many bases. As a result, many of the services provided for members can be undervalued and underutilized by those for whom it is designed.

Although the above-mentioned benefits are real and do provide a value to some members, the overall structure is such that comparison to the civilian workforce is nearly impossible. As a result, servicemembers are unable to compare their compensation among alternatives, causing some to make decisions regarding continued service on other factors. A straightforward solution to this problem would be to emphasize the value of certain services and non-monetary compensation to military members. This is accomplished in the private sector through aggressive communications plans and annual statements to employees.³

2. Flexibility

It has long been argued that the military compensation mechanism, in general, does not provide the necessary flexibility to respond quickly to changing internal needs or external market forces.⁴ With such a rigid pay scale, the Armed Forces are unable to provide performance-based compensation or merit pay, but rather rely on a tenure-based system. Additionally, since uniformed servicemen are not vested in the retirement program until their 20th year of service, members are reluctant to separate as they move closer to that milestone. The military therefore relies on involuntary separations or separation incentives schemes to reduce personnel inventory levels. This can result in reduced morale and views that the military is acting insensitively toward its people by removing them from

3. Thomas M. Strawn. "The War for Talent in the Private Sector." In Cindy Williams (ed.), *Filling the Ranks: Transforming the U.S. Military Personnel System*. Cambridge, MA: MIT Press, 2004.

4. Beth Asch and James Hosek. "Looking to the Future: What Does Transformation Mean for Military Manpower and Personnel Policy?" 2004 (RAND Report OP-108-OSD).

pension eligibility. Such a system does not provide the required flexibility for such a large employer as the United States Armed Forces.

III. NAVY BONUS PROGRAMS

Since changing to an All-Volunteer Force (AVF), military personnel planning has depended on the broader United States labor market conditions. As a result, to meet personnel manning objectives, the Department of Defense must be able to compete with private sector pay and compensation. Moreover, the uniformed services must also meet specific billet requirements, by attracting or retaining those military officers that have desirable skills. Targeted Bonus Pay has been used as a means of meeting these manning objectives.

Current bonus programs all have the common objectives of retaining trained and skilled officers while attracting new officers into a specific career pipeline. The aviation, surface warfare, and the submarine communities are among those career fields where bonuses are being implemented in the Navy today. Each bonus program differs in required commitment, bonus pay amount, and applicability.

A. AVIATION COMMUNITY

1. Aviation Career Incentive Pay

Aviation Career Incentive Pay (ACIP) is a monthly incentive payment available to all “Regular and Reserve Officers who hold, or are in a training syllabus that will lead to, an aeronautical rating or designation and who engage and remain in aviation service on a career basis.”⁵ Pay amounts are based on years of aviation service, including flight training. The monthly amount increases at a step rate from \$125, for 2 or less years of aviation service, to \$840, for over 14 years of aviation service. That the incentive amount increases significantly at the 6 and 14-year points, and then drops on an incremental basis, is not a

⁵ Chief of Naval Personnel. BUPERS Instruction 7220.29A (series): Aviation Career Incentive Pay (ACIP): GPO 17 Jun 2002.

coincidence. These amounts are targeted at critical career points where a bonus might influence retention behavior. See the following table for complete ACIP amounts.

Years of aviation service (includes flight training)	Monthly Rate
2 or Less	\$125
Over 2	\$156
Over 3	\$188
Over 4	\$206
Over 6	\$650
Over 14	\$840
Over 22	\$585
Over 24	\$385
Over 25	\$250

Table 1. Aviation Career Incentive Pay (after Chief of Naval Personnel. BUPERS Instruction 7220.29A (series): Aviation Career Incentive Pay (ACIP): GPO 17 Jun 2002).

2. Aviation Career Continuation Pay

Aviation Career Continuation Pay (ACCP) is designed to supplement ACIP to provide further incentive for qualified Pilots and Naval Flight Officers (NFO) to continue their aeronautical career path within the Navy. ACCP is only available to those Pilots and NFOs who have completed their initial Active Duty Service Obligation (ADSO) and are at a career point where military separation is an option. As a result, the sums of money involved are significantly larger than the ACIP, while increased restrictions are put in place. ACCP is only available to those aviation officers who are qualified or “winged” with a favorable recommendation from their Commanding Officer. Additionally, officers are not eligible to receive ACCP beyond the 25th year of military service or if they have failed to select for promotion twice. Payment is \$125,000 for a commitment to

five additional years of aviation service, payable in five or six equal installments on the anniversary of the individual's commencement date.

Those officers not willing to commit to an additional five years of aviation service can take part in a "short-term" ACCP contract for a period of two years for at-sea service or three years for command billets or astronauts. For this shorter commitment, aviation officers are paid a bonus amount of \$15,000 annually.

ACCP - type	Total amount received
Five year commitment	\$125,000
Two years at a sea command	\$30,000
Three years in command billet	\$45,000
Three years as astronaut	\$45,000

Table 2. Aviation Career Continuation Pay.

B. SUBMARINE COMMUNITY

1. Submarine Duty Incentive Pay

Submarine Duty Incentive Pay (SUBPAY) is analogous to ACIP described above. It is designed to attract and retain submarine service personnel "on a career basis."⁶ It is a monthly payment that is based on rank and years of military service. As a result, the corresponding chart is a bit more complex and appears much like the charts often seen for Base Pay for all military personnel. A similar trend is still evident in the SUBPAY breakdown with incrementally larger dollar amounts occurring at key career decision points.

⁶ Secretary of the Navy. SECNAVINST 7220.65L: Nuclear Officer Incentive Pay. 30 OCT 2003.

					Commissioned Officers									
Pay Grade	2 or less	Over 2	Over 3	Over 4	Over 6	Over 8	Over 10	Over 12	Over 14	Over 16	Over 18	Over 20	Over 22	Over 26
O-10	355	355	355	355	355	355	355	355	355	355	355	355	355	355
O-9	355	355	355	355	355	355	355	355	355	355	355	355	355	355
O-8	355	355	355	355	355	355	355	355	355	355	355	355	355	355
O-7	355	355	355	355	355	355	355	355	355	355	355	355	355	355
O-6	595	595	595	595	595	595	595	595	595	595	835	835	835	835
O-5	595	595	595	595	595	595	595	595	790	835	835	835	835	835
O-4	365	365	365	525	595	705	705	705	790	790	790	790	790	790
O-3	355	355	355	510	595	705	705	705	705	705	705	705	705	705
O-2	305	305	305	305	305	305	425	425	425	425	425	425	425	425
O-1	230	230	230	230	230	230	425	425	425	425	425	425	425	425

Table 3. Submarine Duty Incentive Pay (after Secretary of the Navy. *SECNAVINST 7220.65L: Nuclear Officer Incentive Pay*. 30 OCT 2003)

2. Nuclear Accessions Bonus

The Nuclear Accessions Bonus is a one-time payment made to those individuals selected to enter the Naval nuclear power training pipeline. In effect, it serves as a signing bonus for those officers who decide to pursue a career involving Naval nuclear propulsion in the submarine or surface warfare community. This bonus is currently \$10,000.

3. Nuclear Career Accessions Bonus

Officers who successfully complete the Naval nuclear propulsion training program, receive the Nuclear Career Accessions Bonus. It consists of another one-time payment made upon successful completion of the two phases of Naval nuclear propulsion training: Naval Nuclear Power Training Command and Nuclear Power Training Unit (commonly referred to as “nuclear power school” and “prototype” respectively). This bonus is \$2,000.

4. Nuclear Officer Continuation Pay

The Nuclear Officer Continuation Pay (COPAY) bonus program is a parallel to the ACCP described above. It is designed to provide incentives to nuclear trained officers who have qualified as engineer officer of a nuclear-powered ship. Eligible officers can select a contract length of three, four, or five years in length. Officers that select a four-year or five-year contract receive an annual bonus payment of \$25,000. Officers that opt for the three-year commitment receive an annual bonus of \$22,000.

Once an officer is within one year of completing his or her minimum service requirement (MSR), he or she may enter into a COPAY agreement and receive equal annual payments prior to service. For instance, a nuclear qualified officer one year from completing his MSR, who meets the requirements to enter into a COPAY contract for five years of continued service, will receive six annual payments of \$20,833.33, vice five annual payments of \$25,000.

COPAY - type	Total amount (equal annual payments)
Five-year commitment	\$125,000
Four-year commitment	\$100,00
Three-year commitment	\$75,000

Table 4. Nuclear Officer Continuation Pay.

5. Annual Incentive Bonus

Nuclear-qualified officers wishing to continue service on an annual basis without committing to more than three years of service receive the Annual Incentive Bonus (AIB). The AIB is an annual bonus payment of \$12,500 paid *upon completion* of each full year of additional service. This differs from the COPAY bonus plans whereby the bonus is paid *prior* to each year of service. If

an officer elects to receive the AIB, but separates from the Submarine Community having only completed a portion of a year, no bonus is received for that year.

C. SURFACE WARFARE COMMUNITY

1. Surface Warfare Officer Continuation Pay

Surface Warfare Officer Continuation Pay (SWOCP or “SWO bonus”) is equivalent to the ACCP and the nuclear COPAY described above, with a goal of improving officer retention in an effort to fully man the current and projected surface warfare officer department head billets. Those entering into the SWOCP program are obligated to remain on active duty to complete one or more assignments as a department head afloat.⁷ As an incentive to continued service, the SWOCP offers signors \$50,000 paid in five installments. The first payment is made upon acceptance of the contract, with the four subsequent payments being made once the officer begins his or her department head assignment or department head school (whichever is earlier), and each year thereafter on that anniversary.

2. Junior Surface Warfare Officer Critical Skills Retention Bonus

A recent addition to the bonus structure of the surface warfare community is the Junior Surface Warfare Officer Critical Skills Retention Bonus (Junior SWO CSRB). The Junior SWO CSRB is in addition to the SWOCP and is “designed to be a career incentive, paying eligible lieutenants \$25,000 to stay in the Navy and the SWO community through the ninth year of commissioned service (YCS) and completion of 2 department head tours or the equivalent.”⁸ Officers are paid

7. Secretary of the Navy. SECNAVINST 7220.84: Surface Warfare Officer Continuation Pay (SWOCP). 14 Jan 2000.

8. Chief of Naval Operations. NAVADMIN 012/06: Junior Surface Warfare Critical Skills Retention Bonus 10 Jan 2006.

\$15,000 on the anniversary of their 6th year of service, and \$5,000 each on the anniversary of their 7th and 8th year of service. Although the two aforementioned programs run concurrently, they must be applied for individually.

3. Surface Warfare Officer Critical Skills Bonus

The Surface Warfare Officer Critical Skills Bonus (SWOCS bonus) is aimed at more senior surface warfare officers who have already served, or are serving, in a department head billet. As a result, it is only available to Lieutenant Commanders (LCDR), paying up to \$46,000 to remain on active duty in the Surface Warfare Community through their 15th year of commissioned service. Eligible officers are paid in three installments commencing two years after having been promoted to the rank of LCDR, with two additional annual payments thereafter. Those officers signing a multi-year contract receive an initial payment of \$22,000 followed by two payments of \$12,000. Not signing a multi-year contract instead results in three equal payments of \$12,000 each. The following table illustrates the total payments.

SWOCSB - type	Total amount paid
Three-year Commitment	\$46,000
Single year commitment	\$12,000
3 single year commitments	\$36,000

Table 5. Surface Warfare Officer Critical Skills Bonus.

4. Senior Surface Warfare Officer Critical Skills Retention Bonus

As a means of providing incentives to more senior surface warfare officers, the Senior Surface Warfare Officer Critical Skills Retention Bonus (Senior SWO Bonus) was created. This program offers Commanders (CDR/O-5) serving in eligible billets a yearly bonus of \$15,000 while paying Captains (CAPT/O-6) in eligible billets \$20,000 per year. The bonuses are only available

to those surface warfare officers serving in eligible positions as determined by the Chief of Naval Operations (CNO). The Senior SWO Bonus is not available to those officers who have completed 25 years of active duty service or who will complete their 25th year prior to the end of a payment period.

Senior SWO Bonus	Amount paid
CDR / O-5	\$15,000 per year
CAPT / O-6	\$20,000 per year

Table 6. Senior Surface Warfare Officer Critical Skills Retention Bonus.

5. Nuclear-trained Surface Warfare Officers

For those surface warfare officer who have completed the training and qualification requirements to serve as engineer officer of a Naval nuclear propulsion plant, the above-mentioned nuclear bonuses are payable *in conjunction* with the surface warfare officer bonuses. Namely, the Nuclear Accessions Bonus, Nuclear Career Accessions Bonus, Nuclear Officer Continuation Pay, and the Annual Incentive Pay are available as described in the Submarine Community section.

IV. AUCTIONS

A. AUCTION VOCABULARY

Although auctions can vary significantly based on location, rules, or format, there are certain terms that are constant throughout any auction. For instance, in any auction there are bidders and bid-takers. **Bidders** are the persons or entities competing against each other for the winning price. The **bid-takers** are those who receive the price offers proposed by the bidders. On the other hand, there are sellers and buyers. A **seller** is one who has a good or service that he or she is willing to provide at the right price. The **buyer**, however, is the one looking to purchase the good or service from the seller.

The most commonly recognized auction is one with a single seller of a good and multiple buyers competing for the right to buy the good. This is called a **forward auction**, and is often used for selling artwork, furniture, or other individual items. For this type of auction the winner is the bidder willing to pay the seller the highest price for the item. However, there exists a case with one buyer in search of a good or service with multiple sellers vying for the right to provide the service. This type of auction is called a **reverse auction**, and is commonly used by governments for contracting services to build weapon systems, erect buildings, and create labor contracts. In this situation the winner is the bidder willing to sell the good or perform the service at the lowest cost to the buyer. At the end of this section, Table 7 shows auction terms as they apply to both forward and reverse auctions.

In the end, it would appear that the real “winner” is the person or entity in the power position, able to receive the highest possible price for an item or contract a service at the lowest available cost. More specifically, the seller in the forward auction is considered a **monopolist** while the buyer in the reverse auction is a **monopsonist**. This is not lost in the design of auctions, which would logically be chosen to the advantage of the auction host. However, there are

cases where the monopolist / monopsonist is at a disadvantage. In fact, it is the asymmetry of information that is the fundamental reason to use an auction as the means of engaging in trade.

The key piece of information in an auction is the value of a good or service being auctioned-off. Two cases are considered in the valuation of the good or service for auction. In the first case, an item such as a piece of artwork or property is being sold at auction. In this case the good is part of a market and can be transferred or resold. There is an accepted value for such an item. Nevertheless, no one knows the exact value until it is purchased. Each bidder may have an idea of what it might be worth but cannot be sure. As a result, the bidders will base their bids on those of the other bidders. This auction model is called a **common value** model. On the other hand, there are some things available for auction that are only of value to the bidder. A contractor bidding for the right to provide a service knows what the contract will likely cost him, though he may not know what it will cost the other bidders. Knowledge of this information does not effect his valuation though, since he will be paying for the work and would gain nothing to bid a price below his actual costs plus a desired profit. Similarly, someone bidding for an item for sentimental or personal reasons knows what he is willing to pay for such an item, regardless of what others are willing to pay. This auction model is called an **independent-private-values** model.

A means of expressing valuation by bidders in the conduct of an auction is through the use of a **reservation price**. Reservation price is the maximum a bidding buyer is willing to pay for an item in a forward auction, or the minimum a bidding seller would accept in a reverse auction. This term is also referred to simply as “valuation” in discussions about auctions. Alternatively, bid-takers can make use of a **reserve price**, not necessarily as a form of valuation, but as a way of ensuring adequate/sufficient rent is exchanged in the transaction. A reserve price is the minimum a bid-taking seller is willing to accept for an item in a forward auction, or the maximum a bid-taking buyer is willing to pay in a reverse auction. Deciding whether or not to make one’s reserve price or

reservation price known is an important element to auction design. If a bid-taker announces the reserve price, it could have the effect of anchoring bids to that value, resulting in minimizing economic rent received by the bid-taker. On the other hand, bidders who reveal their reservation price risk being out-bid as other bidders learn their valuation of the item for auction.

Forward Auction		Reverse Auction
Buyers	Bidders	Sellers
Seller (monopolist)	Bid-taker	Buyer (monopsonist)
High-bidder	Winner	Low-bidder
Maximum a bidder is willing to pay	Reservation Price	Minimum a bidder is willing to accept
Minimum a bid-taker is willing to accept	Reserve Price	Maximum a bid-taker is willing to pay

Table 7. Auction vocabulary as it applies to forward and reverse auctions.

B. TYPES OF AUCTIONS

1. Ascending-bid

Often called the open, oral, or English auction, this is the most commonly applied and recognized type of auction. In an ascending-bid forward auction, bidders successively raise the offered price until only one bidder is left willing to pay the proposed price. Once this point has been reached, the remaining bidder is said to have “won” the auction and the item or service for sale. While the style of the English auction is set, the process may differ significantly. An auctioneer may be employed to announce prices and solicit price increases. The bidders

may be allowed to call out their bids verbally or submit bids in written form or electronically, whereby at any point during the auction all other bidders know the current high bid.

2. Descending-bid

Commonly called the Dutch auction, the descending-bid forward auction is a form of auction whereby an initial price is proposed by an auctioneer and is successively lowered until a bidder willing to pay the price makes his desire to do so known. In effect, it is the first bidder that wins due to the declining-price nature of the Dutch auction. Similar to the English auction, all prospective bidders know the current asking price for the item or service up for auction. In practice, Dutch auctions are used in Canada for selling tobacco, in the Netherlands for selling cut flowers, and in Israel for the sale of fish.⁹

3. First-price Sealed Bid

In the First-price sealed bid auction, buyers submit bids that are sealed, and therefore unknown to the other bidders. The winning bid is the one that has the highest price and is sold to the buyer at that price. Bidders have only one opportunity to submit a bid and are unaware of what rivals are bidding. This type of auction is used to sell mineral rights to government-owned land and government procurement contracts.¹⁰

4. Second-price Sealed Bid

Second price sealed bid auctions, or Vickery Auctions, are similar to First price sealed bid auctions in that prospective buyers submit sealed bids on an item or service for amounts that are unknown to other bidders. However, the winner of the auction is the bidder who bids the highest price, but the winner pays a price equal to the second-highest bid. In effect, the winner pays the price

9. R. Preston McAfee and John McMillan. "Auctions and Bidding." *Journal of Economic Literature* Vol. XXV, June 1987, 699-738.

10. Ibid.

of the first losing bid. In theory, the optimal bidding strategy is for participants to bid their true values. In practice, second-price auctions often lead bidders to inflate their bids in attempt to win while still paying a lower price than they actually submit.

C. BIDDING STRATEGIES

1. First-price, Sealed Bid Auction

In a first-price, sealed bid auction, the winning bidder pays what he bid for a forward auction, or gets paid what he bid in a reverse auction. In this case, his surplus depends entirely on his bid. A bidder in a forward auction who bids below his valuation and wins receives a profit, or the bidder in a reverse auction who bids above his reservation price and wins, receives a surplus. However, the bidder must estimate what others are likely to bid to maximize his chances of winning. In the case where there are multiple winners in a first price auction, each bidder will still pay (receive) an amount equal to his bid. However, one can base bidding decisions on the number of items up for auction and the number of bidders. Bidders can use this information to bid an amount that provides the most profit or surplus, knowing that their bid directly controls the amount of profit or surplus received. In the end, in the first-price, sealed bid auction, “the bidder bids some amount less than his true valuation [in a forward auction]: Exactly how much less depends upon the probability distribution of the other bidders’ valuations and the number of competing bidders.”¹¹ The opposite is true for a reverse auction; bidders will bid above their true valuation based on expectations of how others bid.

¹¹ R. Preston McAfee and John McMillan. “Auctions and Bidding.” *Journal of Economic Literature* Vol. XXV, June 1987, 699-738.

2. Second-price, Sealed Bid Auction

In a second-price, sealed bid auction the winning bidder pays an amount equal to the second-highest bid in a forward auction. Likewise, in a reverse auction, the winner is paid an amount equal to the first, non-winning bid. In this case, one's bid is only used to determine if he is a winner. The amount that he pays (or is paid) depends only on the bids of others. If a bidder decides to raise his bid above his valuation in a reverse auction, this will change the outcome only if this bid is higher than someone else's bid, and makes his bid the first, non-winning bid. In such a situation, he has affected the outcome but is not a winner in the auction. It is therefore in the bidder's own interest to bid an amount equal to his true valuation, knowing that if he wins, he will be paid more than his bid. The opposite is true for a forward auction. In either case, for a second-price, sealed bid auction, "each bidder's equilibrium strategy is to submit a bid equal to his own valuation of the item."¹²

D. APPLICATION OF AUCTIONS TO THE NAVY

Auctions applied to Navy Officer Bonuses would be in the form of a reverse auction, comprised of multiple sellers and a single buyer. In this case, active duty URL officers would be sellers bidding for the right to sell their labor to a lone buyer, the Navy. As such, the auction would require a specific format. The format would have to be selected based on the location and availability of the participants. Since Navy Officers are deployed around the world on any given day, the ability to host a live auction is severely limited. Even if the auction were conducted online, the logistics of hosting such an auction would be extremely difficult. Moreover, since there would be more than one winning bidder, the live auction format would be inappropriate.

¹² R. Preston McAfee and John McMillan. "Auctions and Bidding." *Journal of Economic Literature* Vol. XXV, June 1987, 699-738.

The most suitable format for implementation is one of the sealed-bid auctions. This would allow bidders to submit bids over time, as scheduling and mobility permit. The Navy would then select the number of officers needed for any given warfare community, and there would be that quantity of winning bidders, each of whom would be eligible for continued service in the Navy. However, how does the Navy decide whether to conduct a first-price or second-price auction? What are the implications of each?

Implementing a first-price sealed bid auction would mean that each winning bidder would receive a bonus equal to the price that he or she bid. This would likely provide the Navy with net cost savings, since some officers would be willing to accept bonuses below the current levels as described in Chapter III. This would, however, result in officers of equal rank and tenure potentially earning different amounts, which is in contrast with current Navy practices.

On the other hand, a second-price sealed bid auction might not provide significant departure from where the Navy stands today. Theoretically, the current system of Navy Bonus Programs would have the same result as a second-price auction. Remember that in a second-price reverse auction the winning bidders would be paid an amount equal to the first losing bid. Effectively, the offered bonus would have to be just high enough to keep the next marginal bidder. The current policy creates the same result. As retention rates tend to drop off below the desired level, bonus amounts are increased to induce enough officers to remain in their respective warfare communities, without offering a larger bonus whereby too many officers would be willing to remain in service.

1. Auctions in Practice

a. Assignment Incentive Pay

The 2003 National Defense Authorization Act gave the Uniformed Services the authority to implement a program known as Assignment Incentive Pay (AIP). The act allowed each Service to “pay [a] monthly incentive pay ...to a

member of a uniformed service who performs service, while entitled to basic pay, in an assignment designated by the [Service] Secretary.” The Navy’s response to this new authority was to create a type of auction where sailors could submit bids online indicating what additional monthly pay they required in exchange for accepting duty at undesirable locations. Bids were accepted in \$50 increments up to a disclosed maximum reserve price of \$1,500. The format was essentially a first-price sealed bid auction.

b. Voluntary Separation Incentive

Based on positive results of implementing auctions into Assignment Incentive Pay for hard-to-fill jobs, it has been proposed that Voluntary Separations, when required, be conducted under a similar first-price sealed bid format. Such a program would allow the Navy flexibility when reducing manning levels while providing potential cost savings by allowing individuals to compete.

2. Potential Results

Recruiting goals and attracting the desired number of new servicemembers are two goals of the military compensation system. “The purpose of the military compensation system is to attract, retain and motivate sufficient numbers of qualified people in the military, to separate them gracefully, and to do so efficiently.” (Williams: Hogan, 29). However, quantity and quality of people are inextricably linked. Auctions in general can provide the required quantity of personnel desired by the Navy. Accordingly, the concept of quality must be addressed.

a. Adverse Selection

By accepting only the lowest bidders in an officer bonus auction, the Navy risks several undesired results. The first of which is called adverse selection. If the two alternatives for an officer are (1) remaining in the Navy and (2) leaving the Navy in search of a private sector job, the officer will weigh her

options and likelihood of success in each occupation. Those who feel that they would be less likely to find suitable employment outside of the Navy will be prone to place low bids for bonuses allowing them to remain on active duty. A possible result in this scenario is one where those who see themselves having limited success outside of the military are the lowest bidders and the Navy retains an officer corps comprised of men and women that feel their outside options are limited.

This concept can be viewed through a focus on skills. For this purpose, suppose that there are two kinds of skills (1) military-specific skills (e.g. driving a submarine, conning a ship, landing an aircraft on an aircraft carrier) and general skills (e.g. managerial ability, general level of education). Figure 1 provides a graphical view of potential skill combinations.

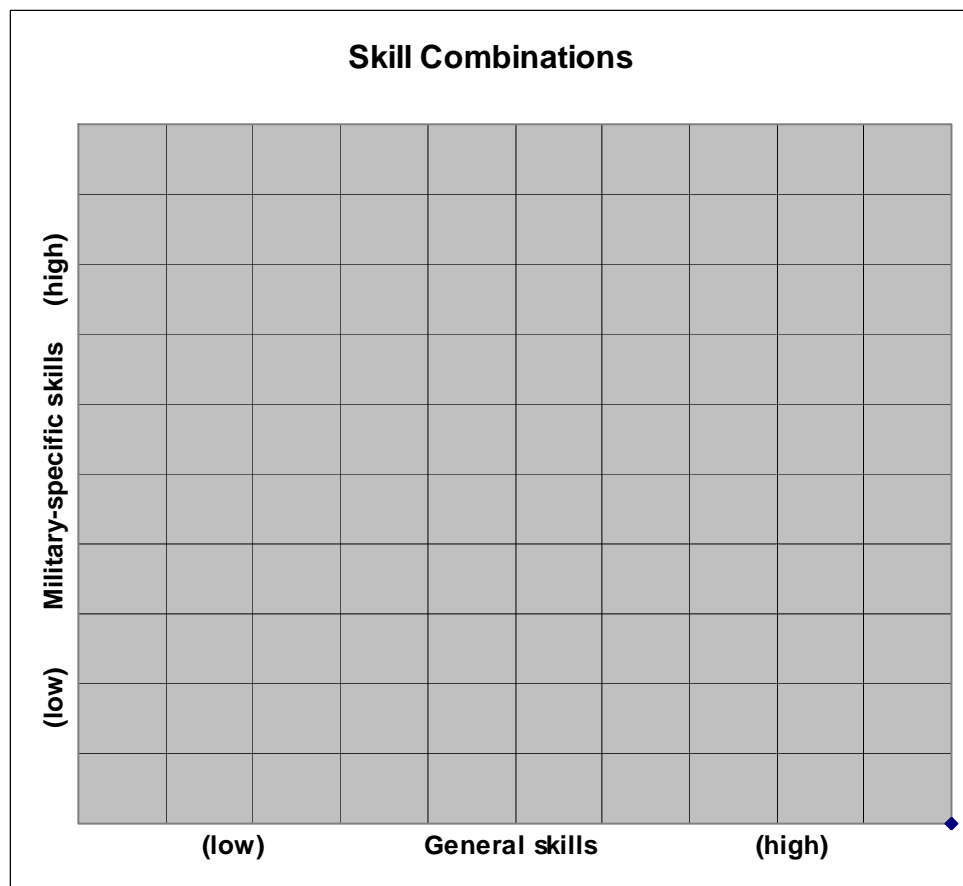


Figure 1. Skill combinations

Ideally, the Navy would like to retain officers who possess high levels of both skills (upper-right quadrant of Figure 1). However, officers possessing that skill set are also those officers most likely to succeed in the private sector. As a result, it is probable that their bids on a bonus to remain in service would be highest. Conversely, those possessing lower levels of each skill (lower-left quadrant of Figure1) are less desirable to the Navy and the private sector. Accordingly, in a bonus pay auction, officers in this lower-left quadrant are likely to bid low, given limited options outside of their current position. Consequently, the lowest bidders are likely to be those possessing a skill set that is less than desirable for the Navy, resulting in a shortage of officers with desired skills.

Although auctions are not currently implemented, the same adverse selection outcome is possible when officers voluntarily sign contracts for future service under the various bonus programs described above. Under the present system, part of this problem is addressed. A requirement that is consistent across communities is that in order to be eligible for a particular bonus, a positive endorsement must be attained by one's previous Commanding Officer or equivalent. This endorsement is based on military performance as demonstrated while at the command and documented in Fitness Reports. In so doing, the Navy seeks to ensure that officers serving under bonus programs at least fall into the upper part of the skill combination illustrated in Figure1, by possessing adequate military-specific skills.

b. Adverse Perception

By adopting a policy which uses auctions to award bonuses to the lowest bidder, the Navy risks being perceived as opportunistic, taking advantage of one's willingness to accept less compensation for continued service. In fact, the Navy's compensation system embodies the concept that personnel receive equal pay for equal tenure and community. This is demonstrated in Navy personnel base pay tables, BAH rates, and various incentive pay scales.

Furthermore, it is written into current bonus program policy. For instance, under the Submarine Officer Continuation Pay (COPAY) program described in Chapter III, eligible officers may sign a three, four, or five-year contract, thereby receiving an annual bonus at the currently offered rate. However, the instruction goes on to say that “should the amount paid to officers who subsequently apply for COPAY be increased, officers with an agreement in effect at a lower rate may request a new agreement at the higher rate.” In other words, once a different amount is made available, all officers are eligible to renegotiate the terms of the existing contract, therefore ensuring equal bonus pay among officers in the same occupation.

Although this model is rarely seen in the private sector, deviation from it could result in adverse perception of the Navy by current and former employees, as well as the general public as a whole. To do so would require a significant Navy communication campaign to mitigate any negative implications. Beyond perception is an operational concern, it has been said that the “military’s continued use of equal pay across occupations may result from the institutional paradigm that occupational pay differentials would harm unit cohesion and teamwork.”¹³ (William: Hogan 43) The author did not find any studies of this dynamic pertaining to the military. One result, however, of the current approach is that officers with certain skills will be underpaid while others are overpaid and market forces and signals are not evident in the military occupation.

13. Paul F. Hogan. “Overview of the Current Personnel and Compensation System.” In Cindy Williams (ed.), *Filling the Ranks: Transforming the U.S. Military Personnel System*. Cambridge, MA: MIT Press, 2004.

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V. SIGNALING

A. BACKGROUND

The concept of Auction Theory as discussed in the pervious chapter deals with information asymmetry. Sellers don't know what buyers are willing to pay and buyers aren't sure what other buyers are willing to pay. Application of Auction theory to Navy Officer Bonus Programs, by definition would lead to the retention of a sufficient number of officers. There is another school of thought addressing hidden information that gives insight into the problem of job applicant quality in the job market: Signaling Theory.

Job market signaling is a concept brought to light by Michael Spence in *The Quarterly Journal of Economics* in 1973. It can be used to resolve information asymmetry between an employer and a prospective employee. Prior to hiring an employee, an employer has very little information on which to base her decision. In fact, for some time after hiring a new employee, his productivity can remain a mystery during training and/or an initial familiarization period common to many occupations. How then, can an employer better judge potential job applicants? The article addresses a way for employers to differentiate between potential job applicants based not only on unalterable characteristics, called indices, such as age and gender but also on attributes, called signals, that can be controlled by the applicant but require some invested time, effort, or money.¹⁴

14. Michael Spence. "Job Market Signaling." *The Quarterly Journal of Economics* Vol. 87, No. 3, August 1973, 355-374.

B. SIGNALING IN PRACTICE

1. Labor Market

An illustration of this concept as portrayed by Spence involves new entrants to the labor market. Effectively Spence asked two questions, “whether, in a competitive marketplace, sellers of above-average quality products could “signal” this fact by taking some costly action. On the other side of the market, could the uninformed buyers use the costly action as a way to “screen” for quality?” (Riley, Silver 1). Since asymmetrical information puts the employer at a disadvantage, she must look to signals made on the part of the applicant to infer the missing information. An obvious potential signal exists in looking at education. One who invests considerable time, money and effort into receiving successful secondary education signals to the employer that he possesses the required skills to gain employment. If the investment were too great and exceeded the expected benefits, the potential employee would not bother with the additional education, but rather accept a lower-paying job. Effectively, applicants have distinguished themselves from one another on the basis of education. In 1973 such a distinction could be inferred by having received a college education. Today, as college graduation is more common, perhaps graduate education could be a similar signal to employers. In either case, employers are able to gain valuable information from the signals put forth by the applicants.

2. Automobile Market

In 1970, George Akerlof wrote about information asymmetry as it pertains to used automobiles.¹⁵ Many vehicles look alike in the used-car market. However, the information unknown to a prospective buyer is the real quality or history of a particular vehicle, known only by the current owner. As a result, the

15. George A. Akerlof. “The Market for ‘Lemons’: Quality, Uncertainty, and the Market mechanism.” *The Quarterly Journal of Economics* Vol. 84, No. 3, August 1970, 488-500.

average worth of used cars is derived from past experience and potential buyers base buying decisions on this average. The highest quality cars will likely be sold immediately or kept by their owners, resulting in a market consisting only of “lemons.” This idea is called adverse selection, which is the result of the asymmetrical information in the market. Applying signaling to this concept results in a thus-far successful solution to the lemon market. Modern-day automobile dealers have attempted to remove the lemon-market stigma attached to used cars by implementing a “certified pre-owned” market consisting of vehicles that have undergone extensive tests or inspections. These vehicles have been subject to a process that costs time and money on the part of the dealer. The result is a “signal” to potential buyers that such vehicles are of better quality than the others in the marketplace, and are sold at a premium.

2. Insurance Market

Another form of signaling used to avert adverse selection is employed in the private insurance market. While providers of insurance would prefer to know everything about those wishing to purchase insurance, the customer does not reveal all relevant information. As a result, insurers rely on signaling by allowing the customers to segment themselves. This is done through the use of various combinations of deductibles and premium payments. Most often, insurance providers (medical insurance for instance) offer policies with high deductibles and low recurring premiums or policies with low deductibles and high recurring premiums (with various combinations in between). While the insurer may not know how to sort the customers, such a schedule allows customers to sort themselves. Those who consider themselves to be healthy and less likely to require medical treatment select a high deductible, low premium plan. On the other hand, one who is unhealthy, or has a predisposition to be so, would be more likely to select a low deductible, high premium plan due to his propensity to use the insurance. As a result, the insurer can now infer information based on

the behavior of the customers, and reflect this in insurance decisions. Obviously this is not foolproof, for some customers may require more services than expected.

C. APPLICATION TO THE NAVY

1. Key Promotion Points

One way that signaling is used in the Navy is through an officer's attainment of key promotion points. In the Navy, as in each of the other services, upward promotion is contingent upon satisfactory performance as well as achieving key milestones in one's career. Examples of these milestones include community-specific qualifications, successful completion of Joint Professional Military Education (JPME), and successful completion of a graduate degree program. Completing these activities signals to the Navy Personnel Command and promotion boards that an individual is putting forth the required effort to be promoted. However, many of these key points are scheduled into an officer's career path within a warfare community, not allowing an officer to actively signal his or her intentions. In the end, the Navy does not know which officers intend to continue service and which intend to separate, causing all members to receive equal compensation regardless of one's personal "reservation price."

2. Up-or-out Contracts

Like many other occupations, the Navy uses a promotion-based system that can be called "up-or-out," after a predetermined period of employment, if promotion does not occur, the employer reserves the right to terminate the employee-employer relationship (i.e. to fire the employee). This method of contracting was implemented in the world of academia (requiring someone to earn tenure) or in the legal profession (necessitating lawyers make partner). The concept of implementing up-or-out contracts has long been studied in the world

of economic literature. The idea behind such an employment policy is that employers set wages higher than the opportunity cost of the employee, with the hopes that the employee will increase his productivity enough to be retained.¹⁶ Otherwise, the employee is involuntarily separated.

While productivity in military service cannot be measured with dollars, it is nonetheless measured. Fitness Reports are used to document an officer's performance while stationed at a given command. Officers should therefore seek to improve their military performance in order to meet their side of the up-or-out contract. However, Fitness Reports are not the only determinant of one's ability to be promoted. The key promotion points discussed above are also vital to upward mobility. As mentioned, they do not provide for active signaling by the individual to the Navy. Fitness Reports can work the same way. Officers with no intention of continuing Naval service can be evaluated favorably on Fitness Reports. In fact, it makes sense to ensure that this is so, due to the officer's ability to use Fitness Reports as evidence of military successes when transitioning to the private sector. In the end, the Navy is left with the same asymmetrical information, whether or not an individual intends to continue service in the U. S. Navy. Lacking this information, retention bonuses are levied to all officers when only some require additional monetary incentive.

16. Charles Kahn and Gur Huberman. "Two-sided Uncertainty and "Up-or-Out" Contracts." *Journal of Labor Economics* Vol. 6 No. 4, October 1988, pp. 423-444.

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VI. ANALYSIS AND INTERPRETATION

A. INCORPORATING SIGNALING AND AUCTIONS TOGETHER

Based on the previous chapters, it is evident that restructuring the officer bonus program is possible, though it must be done in an equitable way. Auctions alone can provide the needed quantity of officers just as signaling alone can help ensure the right quality, but taken separately there is little potential for cost savings in an equitable format. Combining them into a new program has great potential to provide flexibility to the Navy, maintain the appropriate quantity and quality of officers, and provide cost savings to the Navy, while providing continued servicemember satisfaction.

The proposed program is one that allows officers to signal their intentions to the Navy by offering contracts of different lengths, with officers determining the respective bonus amounts by taking part in a reverse, second-price auction. The signaling aspect of the program provides the Navy with insight into personnel manning trends, while allowing individuals to express their preferences financially. The auction aspect of the program ensures competition for bonus amounts in a format that promotes honest bidding, while providing the Navy with the surety that bonus amounts are reflective of the overall economy and job market.

1. Signaling

The use of Fitness Reports to screen potential officers is a fundamental part of the promotion and bonus system, and should remain so. By ensuring that all officers who continue service have at least the required military proficiency, the Navy increases the likelihood that those officers will provide the required skills in future periods. On the other hand, the practice of offering the same bonus amounts to each officer is a potential source of cost savings to the Navy. Under the current system where each officer is eligible for the same bonus amounts, there are those who would surely be willing to remain on active duty for

less. Therefore, providing a menu of bonus amounts of varying timeframes is an intriguing idea.

Some programs do offer different bonuses based on the contracted timeframe. However, like the Submarine Community Program described in Chapter III, longer contracts pay more per year than shorter contracts. This can provide an incentive for personnel to sign longer contracts. While seemingly intuitive, this framework can also result in the separation of highly qualified officers who are not willing to sign long-term contracts. Alternatively, offering higher bonus amounts for short-term contracts could easily result in more people taking the short-term contract for more money with the intention to do so repeatedly until retirement, offering no savings to the Navy. Strict doctrinal adherence to this concept limits the Navy's flexibility and limits options for higher skilled officers considering separation.



Figure 2. Hypothetical range of annual wage options to Navy officers in the private sector.

Suppose the potential range of annual wages in the private sector available to Navy officers (or more generally opportunity costs for remaining on active duty) is shown in Figure 2 above. This spectrum is based on current economic conditions, the individual officers' general skill level, perceived employment options in the civilian workforce, and potentially tastes for military

service. Those with a propensity to remain on active duty without large bonuses would be found on the lower end of the range while those with a propensity to leave the military for the private sector would fall on the high end of the range, requiring larger monetary incentives to continue military service.

Assume also that the average wage (including base pay, BAS, and BAH) is \$70,000 per year without a bonus. Using a simple example of one bonus option, potential cost savings can be illustrated. If the only bonus option available to officers is a four-year contract for an additional \$20,000 per year (as depicted in Figure 3), the Navy will receive a certain number of officers who accept the terms. However, some would have stayed for less money. Actually, all but the last officer who is indifferent between the \$90,000 per year (reservation price) and his opportunity in the private sector would accept less, providing each of them with a surplus.

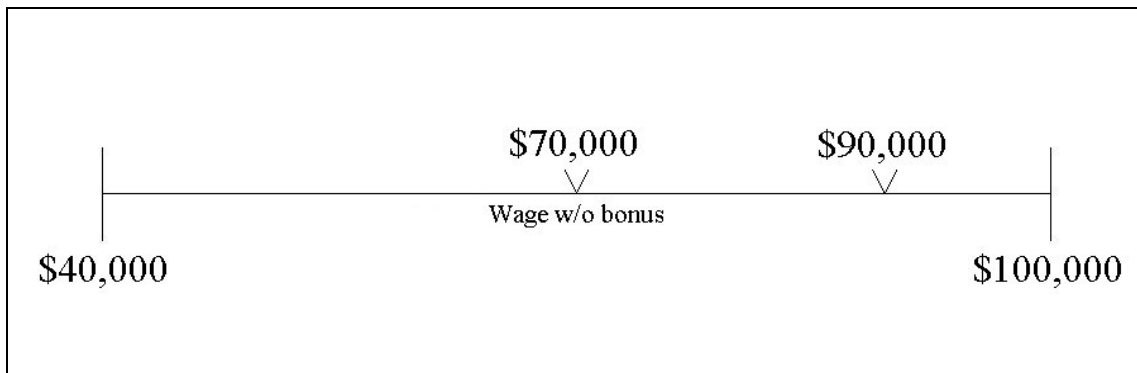


Figure 3. Base wage and wage of officer accepting a bonus of \$20,000.

None of the officers who have opportunities in the private sector in excess of the additional \$20,000 per year would volunteer, causing the Navy to lose those officers who are likely to be highly-skilled. Is the only method of retaining these highly skilled officers to offer a larger bonus to all officers? This author says no. Instead, by offering two types of contracts, the Navy could retain the appropriate number off officers but also capture some of those officers who might have rejected the \$20,000 bonus offer.

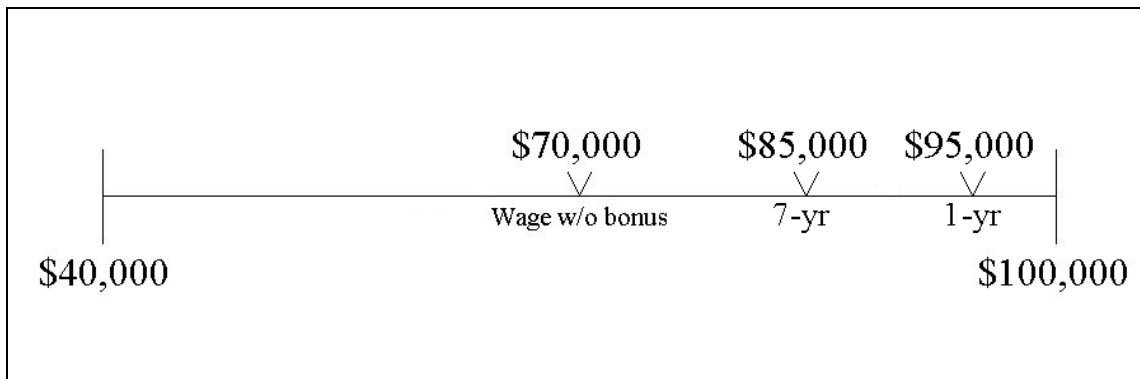


Figure 4. Wages with two bonuses: \$15K for seven years and \$25K for one year.

Now say that the Navy offers two bonus contracts: (1) a seven-year contract for \$15,000 per year and (2) a one-year contract for \$25,000 as shown in Figure 4 above. In this case, those willing to remain in service for an annual bonus of \$20,000 would still be willing to accept one of the two offered contracts. Additionally, some officers who would have previously been priced-out at \$90,000 would now be willing to accept a contract, specifically those requiring a bonus between \$20,000 and \$25,000 per year. Presented as such, there is nothing to inhibit all of the officers from electing contract (1) over multiple periods. Choosing such an option repeatedly provides the officers with the most surplus, but only if it is known that this amount will be offered each year ad infinitum. Therefore, an important distinction must be made between the two choices.

In the annual bonus case, the bonus amount is higher, but it is for a much shorter timeframe. If the one-year retention bonus amount varies each year, or is not even offered in years when competition with the private sector is limited, or the Navy chooses to shape the force, the dynamics of the bonus program change. Incorporated into this type of format is a certain amount of risk. There is the risk that the next annual bonus offered will decline, perhaps even below the \$15,000 dollars being offered for a longer-term contract. As a result, those who would be willing to remain in service for less than the \$15,000 might prefer the

security provided by a long-term contract. Concurrently, those officers who were reluctant to sign a contract for four years at \$20,000 might be more likely to remain on active duty for an additional year at the new, higher rate.

To mathematically demonstrate that not all officers will select the short-term, high-bonus offer, the concept of discounting and probability can be used. An individual officer's reservation wage (the lowest acceptable military wage based on private sector opportunities) is represented by R , with total wages including the available bonus amounts equal to B_1 and B_2 . B_1 is the wage received while serving under a seven-year contract, while B_2 is the higher wage amount received while serving under a one-year contract. In both cases, the officer will receive a surplus above his reservation wage. To compare the two options, it is necessary to look at the present value (PV) of seven years worth of surpluses for each contract. In the first case, the present value of seven years of surpluses can be represented by the following formula, using a discount factor equal to D :

$$PV = (B_1 - R) + (B_1 - R) \cdot D^1 + (B_1 - R) \cdot D^2 + \dots + (B_1 - R) \cdot D^6$$

However, under the one-year contract there is a risk at the beginning of each year that the officer would not be selected for continued service. Based on a probability of being eligible for the contract in the subsequent year equal to P , the present value of seven years worth of surpluses under the one-year contract can be calculated using the following formula:

$$PV = (B_2 - R) + P \cdot (B_2 - R) \cdot D + P^2 \cdot (B_2 - R) \cdot D^2 + \dots + P^6 \cdot (B_2 - R) \cdot D^6$$

Assuming that wages in the military and in the private sector increase at a rate equal to inflation, and this is equal to the discount rate, D can be ignored. The following equations result:

$$PV = 7 \cdot (B_1 - R) \quad \text{AND}$$

$$PV = (B_2 - R) + P \cdot (B_2 - R) + P^2 \cdot (B_2 - R) + \dots + P^6 \cdot (B_2 - R)$$

For a given P , B_1 , and B_2 , there is a reservation price (R) at which an individual would prefer the lower wage, long-term contract to the higher wage, short-term contract. Setting the two equations equal to each other and solving for R will yield the reservation wage at which an individual is indifferent between the two choices.

$$7 \cdot (B_1 - R) = (B_2 - R) + P \cdot (B_2 - R) + P^2 \cdot (B_2 - R) + \dots + P^6 \cdot (B_2 - R)$$

Solving this equation using the given values above ($B_1 = \$85,000$, $B_2 = \$95,000$) with $P = 75\%$, the reservation wage, R , comes out to equal approximately \$75,000. This shows that for the two available bonuses, with a 75% probability of being eligible for one-year contracts each year, officers with a reservation wage less than \$75,000 are likely to receive the most surplus by selecting the longer-term contract, albeit at a lower bonus amount.

Cost effectiveness can be viewed in three ways pertaining to this simple example. First, if an equal number of people shift from the \$20,000 per year bonus to each of the \$15,000 and \$25,000 options there is no additional cost to the Navy, but it has improved the overall officer skill set (more officers will choose to remain on active duty). Next, if more people shift to the \$15,000 level than move to the \$25,000 the Navy will have saved costs and potentially increased the skill level of the retained officers. Lastly, there is the case where more people shift to the \$25,000 than the \$15,000 increasing costs but also increasing the underlying skill set of the Navy's officer corps. It is important to remember that adverse selection is minimized through the continued reliance on Fitness

Reports to screen officers to ensure that they do not fall into the lower portion of the skill combination diagram (Figure 1) on page 28.

This simple example helps to illustrate that offering two bonus programs at different rates and time commitments can increase cost effectiveness at a minimum, but can also increase the overall quality of officers retained. By allowing officers to signal their intentions to the Navy while accepting an amount of risk commensurate with their reservation price, the Navy can realize personnel improvements. Using this as a first step, auctions can then be incorporated to help determine the appropriate monetary values to offer under each contract.

3. Auctions

Continuing with the two bonus options above, a seven-year contract with an annual bonus and a one-year contract with a one-time, larger bonus, how does the Navy select the two bonus amounts? At the present time, Navy Policy makers observe personnel retention changes from one period to another and raise bonus amounts incrementally, up to a Congressionally set maximum. However, the idea is to provide flexibility to the Navy, allowing responsiveness to the civilian labor market. When the economy as a whole is strong and job market competition between the Navy and private sector is high, bonuses must be higher. Conversely, when the general economy is weaker, resulting in reduced competition between the private sector and the military, bonuses should be reduced. What better way to ensure that this takes place than to let the job market participants compete against one another in setting the bonus amounts?

Since Navy officers must make the choice between continued service and the private sector, one of the considerations in doing so is financial. Officers must consider forgone wages, opportunity for promotion, and opportunity for future choices when picking one occupation over another. As a result, officers will have different financial preferences. An officer who gains utility from some of the non-monetary forms of compensation described in Chapter II might require less monetary incentive to remain in military service. Perhaps his personal

satisfaction and dedication to military service is high. Such an officer would likely require a smaller bonus amount to remain on active duty. An officer that does not receive the same non-monetary gain, and has aspirations of success in the private sector will likely require a larger bonus to remain in service, particularly under a long-term contract. However, she may be willing to remain in the Navy for an additional year for a smaller amount than required for a longer-term commitment.

As an example, the first officer might be willing to sign a seven-year contract in exchange for the \$15,000 annual bonus discussed above. He could be equally willing to sign a one-year contract. The second officer may be more reluctant to sign a multi-year contract, and would therefore require a significantly larger bonus to do so (e.g., \$50,000). A one-year contract, however, is not as binding as a longer one and still allows her to have flexibility in her career choice one year from now. She may therefore be willing to remain on active duty for another year with a bonus amount less than that of a multi-year contract (e.g., \$25,000).

By implementing an auction for bonus amounts, the Navy helps to ensure that bonuses will be competitive with the overall job market. Knowing that officers are competing against each other to set the bonus amounts also helps to keep bonus amounts low. This can be accomplished through the offering of a second price, sealed-bid auction. The number of contracts to be chosen from each auction can be set by Navy policy-makers. Such a tool will provide added flexibility to the Navy's force shaping mechanism. For instance, if the Navy anticipates reductions in the number of required officers in the subsequent years, more officers can be selected from the short-term contract auction. Force levels can continue to be evaluated on a yearly basis and the ratio of the number of short-term contracts awarded to long-term contracts can vary as necessary.

B. RECOMMENDATIONS

1. Structure

Officers with any interest in continued service in their respective warfare community would take part in an auction for each of the two offered contracts (short-term and long-term). Officers must bid on both contract lengths. It is in this manner that signaling enters the picture. Officers signal their intentions to the Navy in financial terms based on the desired contract length. The lowest bidders from each auction will be awarded a contract for the respective timeframe with an annual bonus in the amount of the first non-winning bid. Application of this format does not ensure that short-term contracts will award bonuses that are less than long-term contracts, as is currently the case. However, all candidates know that bonus amounts are set by competition with their peers with consideration of private sector alternatives.

With an eye towards future personnel inventory requirements, Navy policy-makers can determine what fraction of contracts will be awarded to each contract length. The Navy may chose to disclose this information prior to an auction or after bidding is completed. If this information is available to bidders, it could reveal the competitiveness of a particular contract or lack thereof, resulting in changes in behavior by the prospective officers. In addition, based on the bidding outcome for each contract length, the Navy can select an appropriate quantity of each to offer, even to the point where no one is selected for a particular contract is offered if bids are excessive.

Auctions should be conducted annually over a predetermined timeframe (e.g. one month), to allow all participants the timely submission of bids with regard to individual operational requirements. Each auction must be competitive between members of their respective warfare communities. For example, it would be inappropriate for prospective Commanding Officers to compete for bonus amounts with Junior Officers who have just completed their initial Active Duty Service Obligation. Each of these officers has different responsibilities within the Navy and different opportunities outside of military service.

Accordingly, auctions should be conducted among peer groups, such as Junior Officers, Department Heads, etc. In so doing, the Navy promotes adequate competition within each group while capturing the appropriate level of competition with the private sector.

2. Conditions

Like current bonus plans, prospective officers must certainly meet predetermined eligibility conditions. As discussed, positive endorsements by one's Commanding Officer along with minimum performance requirements as measured by Fitness Reports are essential components of an effective personnel continuation policy. Through the continued use of this screening mechanism, the Navy will ensure that all prospective officers possess the skills necessary for continued service in their respective warfare communities.

Additionally, participation in the proposed bonus program must be considered binding. Whichever contract length the bidding officer wins, must be a commitment to accept that contract and remain on active duty for the requisite number of years. By requiring the winners to accept the winning bid, the Navy ensures that officers will bid their honest value for each contract. Over-bidding may result in involuntary separation, whereas underbidding would potentially lower the winning amount, but winners will still receive a surplus since the bonus amount will be greater than all of the winners' bids.

The contract could also require the officer to achieve a promotion during the time of the contract as appropriate and/or qualify for the next senior position such as Executive or Commanding Officer. By incorporating such a stipulation, the Navy gives incentive to the officer for continued success and investment in one's own human capital. Failure to do so could result in officers failing to promote or screen for their next assignment, and thereby having to separate and forfeit future bonus installments.

It is entirely possible that an officer could be in the winning party of both auctions if the bids are low enough. Such a conflict would have to be resolved,

since an officer cannot take part in multiple contracts. To resolve such an event, individuals winning both auctions will be allowed to choose which contract they prefer, ex post. This decision will likely be based on the surplus received from each bid and the individual's tolerance for risk versus job security. Allowing individuals to choose how they would like to resolve the issue would likely increase the program's efficacy.

Lastly, the contracts signed by winning bidders must be binding, and not transferable or renegotiable. Officers serving under one contract would not be eligible to take part in the annual auctions hoping to increase their surplus. To allow officer to do so removes the flexibility component of this program, and reverts to the similar activity under current policy whereby officers can sign new contracts each year as the annual bonus amounts increase.

C. EXPECTED RESULTS

1. Short-term Results

Implementation of such a bonus program will certainly be met with some resistance and reveal other opportunities for improvement. However, the potential gains in skill level and flexibility are vital to the continued modernization of the Navy's personnel total compensation system. Fostering competition for annual bonuses among peer groups ensures that all participants place their bids based on their true value of the bonus. Risking separation for bidding too high is a large price to pay for someone who wants to continue in Naval service. Additionally, the ongoing risk of continued auctions and fluctuating bonuses helps to promote more competition for longer-term contracts, thereby revealing the private value of bonuses. However, since this proposal calls for a second-price auction, each winning bidder is guaranteed to receive a bonus that is larger than his or her bid, contributing to individual satisfaction while further enticing competitive bidding.

Over the first few periods in place, it is possible that there will be little variation in bonus amounts from current programs as a result of the concept of anchoring. Simply stated, anchoring is “clinging to a fact or figure that should have no bearing on your judgments or decisions.”¹⁷ Since this program would be so new and unlike any other program implemented in the Navy, participants could easily default to an amount that they are comfortable or familiar with. Since bonus amounts tend to remain flat or increase over time, individuals are likely to anchor to current levels at first. Even over multiple periods, the same phenomenon could occur as a result of confirmation bias. Confirmation bias “consists of a tendency to search for, treat kindly, and be overly impressed by information that confirms...initial impressions or preferences.”¹⁸ For instance, if the first bonus auctions occur and bidders do not vary significantly from current levels resulting in a similar bonus amount, that level may be confirmed in the minds of participants and future participants. However, over time, as fluctuations occur, bidders’ true valuations will emerge.

As with any new program, participants will have to become familiar with the process and rules that are implemented. Similarly, detailers and others providing guidance must also be very familiar with the process. Therefore, significant information must be made available to each officer to ensure thorough understanding of the concept of reverse, second-price auctions. Many are familiar with the English Auctions that are conducted on websites like E-Bay or at auction houses, but are less familiar with this type of proposed auction. The recommended format and the idea of lower bids having an increased likelihood of success can confuse bidders unfamiliar with the concept. A suggested piece of information might include a Frequently Asked Questions (FAQ) newsletter containing likely questions such as: “Why is it better to bid my true value?” or “What are the risks of bidding too high?” Another tool for clarification could

17 Gary Belsky and Thomas Gilovich, *Why Smart People Make Big Money Mistakes and How to Correct Them: Lessons From the New Science of Behavioral Economics* (New York, NY: Fireside).

18 Gary Belsky and Thomas Gilovich, *Why Smart People Make Big Money Mistakes and How to Correct Them: Lessons From the New Science of Behavioral Economics* (New York, NY: Fireside).

include a website simulator allowing the participants to take part in mock auctions to see the results.

2. Long-term Effects

In the long run, this type of bonus program has great potential. While certainly some of the potential pitfalls described above can occur in the short term, once they are corrected, the Navy Officer bonus program can be a dynamic, flexible plan for officers and the Navy. After a few periods of bidding, members are likely to consider the process routine, and simple. As some members hold reservation wages above the winning bonus amounts and are not selected for continued service, others will receive a bonus in excess of their bid. This will have the effect of driving bids down. Having lower bonuses will not have a dramatic effect on overall quality of life for officers, since each of the other forms of compensation outlined in chapter II would still be in place.

3. Conclusion and Recommendations for Further Study

Currently, bonus programs offered to officers are static plans, increasing periodically as a result of retention or force-shaping needs. Bonus amounts rarely, if ever, decline in nominal terms making it appear to servicemembers that it is only another part of ordinary pay. Such a system does not allow individual officers to signal their intentions or willingness to continue service. Establishing a program whereby officers can signal their long-term intentions can provide the Navy with more forward-looking information.

As it stands now, shorter bonus contracts provide less monetary incentive than those of a longer-term. This has the effect of driving out those officers who may be highly skilled and therefore require a larger monetary incentive to continue service. If such an officer is reluctant to commit to a long-term contract, he will be more reluctant to commit to a short-term contract for fewer dollars. By offering a tiered system, that allows both short-term and long-term contract bonuses to fluctuate, even allowing the shorter-term contract bonus to exceed

the longer-term contract bonus, the Navy can improve its underlying officer skill set by attracting the higher skilled officers.

In order to determine the proper values for each contract length, a second-price, sealed bid auction is proposed. Such a program would ensure that officers bid based on current economic conditions in the overall job market. Competing bids will help constrain bonus payments. It is likely that longer-term contract bonuses would be less than shorter-term contract bonuses because of the security and avoidance of risk that they provide. By selecting the desired ratio of short-term to long-term contracts, the Navy gains access to a valuable force-shaping tool. During times of downsizing, more short-term contracts can be awarded. Alternatively, during times where high rates of retention are desired into the foreseeable future, longer-term contracts can be favored. In either case, the Navy can be sure that the bonus amounts are the proper amounts, since the job market participants themselves will have set them.

Further study and research will only lead to improvements in this area. While this thesis addresses the program from an academic and theoretical perspective, the use of experiments would provide real data for analysis. Groups of officers from various warfare communities could take part in controlled experiments on a variety of different ways to conduct such an auction. A valuable outcome of these experiments could be bidding strategy data based on what information is provided to the bidders. For instance, if the Navy makes known the exact number of officers to be retained, or what ratio of long and short-term contracts will be chosen, bidders' behavior will likely change. If the Navy's reserve price is made available (the most they are willing to pay the winning bidders), officers are likely to change their behavior. Other valuable information can be gained as well through continued research in this area. The results of smaller test groups can then be applied to a larger segment of the Navy officer community.

Analyzing future studies can provide the Navy with insight into such a program's feasibility. If results indicate that individuals do not behave as

expected and outlined in this thesis, the Navy can choose not to implement this alternative approach. However, if cost savings can be realized, as predicted, the Navy will have at its disposal another force-shaping tool. In the end, the goal is to provide the Navy with a flexible, effective officer bonus program that is responsive to the current job market conditions. As private sector compensation methods evolve, so too should the Navy's.

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